



# Algebra I Strand

14 questions	12 questions	17 questions	17 questions	8 questions	12 questions
Number Sense	Statistics, Data Analysis, Probability	Measurement and Geometry	Algebra and Functions	Math Reasoning	Algebra I

Twelve of the 80 CAHSEE multiple-choice questions are based on ten of the Algebra I standards.

## WHAT DO THE ALGEBRA I STANDARDS ASK ME TO DO?

To answer the CAHSEE Algebra I questions, you'll need to know how to:

- recognize equivalent forms of polynomials and other algebraic expressions
- understand the meaning of *opposite*, *reciprocal*, *root*, and *absolute value*
- identify the graph that matches a particular linear function and find its slope and intercepts
- know that lines on a graph are parallel if and only if they have the same slope
- solve linear inequalities
- solve problems involving rate, average speed, distance, and time
- identify the solution to a system of two equations in two unknowns
- solve classic algebra rate, work, and percent mixture problems

## Vocabulary

The words below have appeared on the CAHSEE during past administrations. If any of these words are unfamiliar to you, look them up in the CAHSEE Math Vocabulary list in the appendix at the back of this study guide, or check with your math teacher.

absolute value

y-intercept

equation, inequality

parallel

slope of a line

## WHY IS ALGEBRA I IMPORTANT?

The Algebra I standards expand and deepen basic algebra skills included in the grade seven Algebra and Functions strand. Many people working in technical, scientific, and health-related jobs need a working knowledge of Algebra I. The anchor problem for this strand, *Mixing a Prescription*, shows how a pharmacist might use algebra on the job.

In the U.S. today, algebra has become a “gatekeeper” subject even in fields that don’t actually use much algebra on the job. The reality nowadays is “if you don’t know algebra, you don’t get into either the University of California system or the California State University system.” Knowing the basics of algebra enables you to keep your future options open.

## HOW WILL THE CAHSEE TEST MY KNOWLEDGE OF ALGEBRA I?

The CAHSEE tests ten of the 29 standards from the Algebra I strand. Let's start by looking at five of these standards and some actual CAHSEE questions based on them. Each box that follows contains one of the standards, a released question based on that standard, and a solution with explanation.

**AI 2.0** Students understand and use such operations as taking the opposite, finding the reciprocal, and taking a root, ~~and raising to a fractional power~~. They understand and use the rules of exponents. [1 question] (Note: The crossed out portion will not be tested on the CAHSEE.)

### Released CAHSEE Question

If  $x = -7$ , then  $-x =$

- A  $-7$
- B  $-\frac{1}{7}$
- C  $\frac{1}{7}$
- D  $7$

M02863

### Solution

The correct answer is **D**. If  $x = -7$  then  $-x = 7$ , because “ $-x$ ” means “take the opposite of  $x$ .” Because  $x = -7$ , the opposite of  $-7$  is  $7$ . Number pairs that are opposites add to 0, therefore the opposite of  $-7$  is  $7$  because  $-7 + 7 = 0$ .

Number pairs that are reciprocals multiply to give 1. For example,  $7$  and  $1/7$  are reciprocals because  $7(1/7) = 1$ . Choice B is incorrect; it is the reciprocal of  $-7$ .

**AI 3.0** Students solve equations and inequalities involving absolute values. [1 question]

### Released CAHSEE Question

If  $x$  is an integer, what is the solution to  $|x - 3| < 1$ ?

- A  $\{-3\}$
- B  $\{-3, -2, -1, 0, 1\}$
- C  $\{3\}$
- D  $\{-1, 0, 1, 2, 3\}$

M03035

### Solution

Let's test the numbers in each set of  $x$ -values to see if they make  $|x - 3| < 1$  true. Check choice A by putting in  $-3$  for  $x$ . Is  $|-3 - 3| < 1$ ? No, it is not because  $|-3 - 3| = |-6| = 6$ , and  $6$  is not less than  $1$ . So choice A is wrong. Also, you now know choice B is incorrect, because  $-3$  is in that set.

Next let's try choice C. If  $x$  is  $3$  then  $|x - 3| = |3 - 3| = |0| = 0$ . Because  $0 < 1$ , choice C could be the answer, but we still need to check to see if choice D might be even better. Try letting  $x$  be  $-1$  first. Then  $|x - 3| = |-1 - 3| = |-4| = 4$ . But  $4$  is not less than  $1$ . So D cannot be the answer. Therefore, the correct answer is **C**.

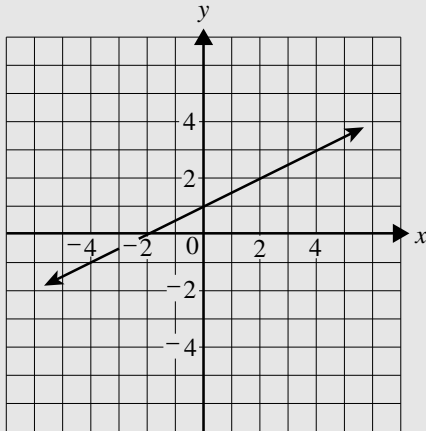
Another way to analyze this problem is to use the fact that the absolute value of a number is the number's distance from 0 on the number line. So, if the absolute value of  $x - 3$  is to be less than or equal to 1, then  $x - 3$  must be between  $-1$  and  $1$ . This gives two inequalities:  $-1 < x - 3$  and  $x - 3 < 1$ . Solving each of these inequalities you get that  $2 < x$  and  $x < 4$ . So,  $x$  must lie between 2 and 4. The only integer that is both greater than 2 and less than 4 is 3. So, the correct solution set is  $\{3\}$ .

**AI 6.0** Students graph a linear equation and compute the  $x$ - and  $y$ -intercepts (e.g., graph  $2x + 6y = 4$ ). ~~They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by  $2x + 6y < 4$ ).~~ [1 graphing item; 1 computing item] (Note: The crossed out portion will not be tested on the CAHSEE.)

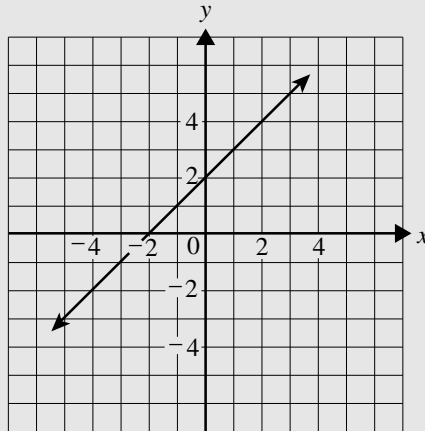
### Released CAHSEE Question

Which of the following is the graph of  $y = \frac{1}{2}x + 2$ ?

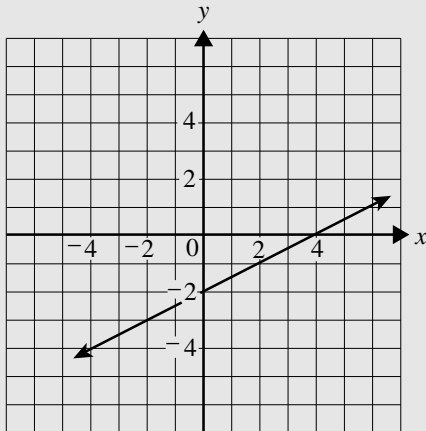
A



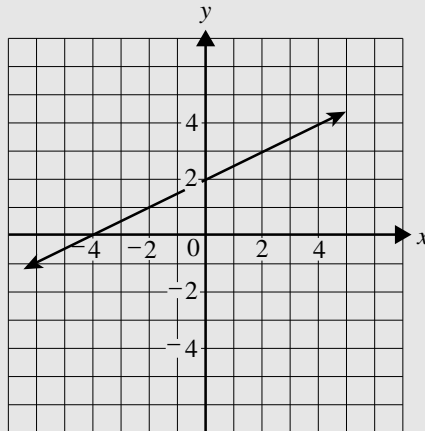
C



B



D

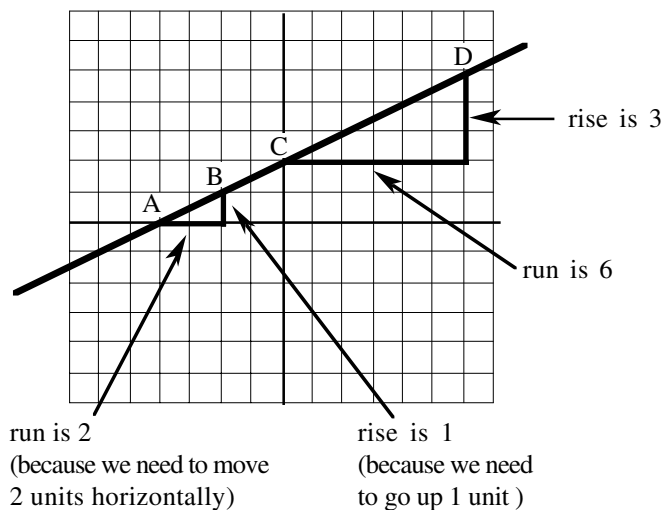


M02026

### Solution

Notice that the equation  $y = \frac{1}{2}x + 2$  is in “slope-intercept form” for linear equations where the slope is “ $\frac{1}{2}$ ” and the  $y$ -intercept is at 2. Which graphs have a slope of  $\frac{1}{2}$ ? In a graph we can find the slope by looking at the ratio “rise over run.” If we pick any

two points on the line, we can look at the vertical and horizontal changes to find the slope:



To move from point A to point B on the line, the ratio of rise to run is  $\frac{1}{2}$ . For a line, the slope ratio always reduces to the same fraction, no matter which two points are selected. To move from point C to point D on the line, the ratio of rise to run is  $\frac{3}{6}$ , which still equals  $\frac{1}{2}$ . Looking back at the answers to this CAHSEE question, you can see that graphs A, B, and D all have slopes of  $\frac{1}{2}$ . But graph C has a slope of 1, so we know it is not the correct answer.

Next we need to look for the correct y-intercept. Which graph has a y-intercept of 2? Not graph A; its y-intercept is at 1. Nor graph B; its y-intercept is at  $-2$ . But graph D does have a y-intercept of 2. Therefore, the correct answer is **D**.

**AI 7.0** Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations ~~by using the point-slope formula~~. [1 question] (Note: The crossed out portion will not be tested on the CAHSEE.)

### Released CAHSEE Question

Which of the following points lies on the line  $4x + 5y = 20$ ?

- A (0, 4)
- B (0, 5)
- C (4, 5)
- D (5, 4)

M02565

### Solution

We can test each point's coordinates in the equation  $4x + 5y = 20$  and see which one works. Let's start with choice D and work backwards.

(5, 4)\_ Does  $4(5) + 5(4) = 20$ ? No

(4, 5)\_ Does  $4(4) + 5(5) = 20$ ? No

(0, 5)\_ Does  $4(0) + 5(5) = 20$ ? No

(0, 4)\_ Does  $4(0) + 5(4) = 20$ ? Yes! So the correct answer is **A**.

**AI 8.0** Students understand the concepts of parallel lines and perpendicular lines and how their slopes are related. ~~Students are able to find the equation of a line perpendicular to a given line that passes through a given point.~~ [1 question] (Note: The crossed out portion will not be tested on the CAHSEE.)

### Released CAHSEE Question

Which of the following could be the equation of a line parallel to the line  $y = 4x - 7$ ?

- A  $y = \frac{1}{4}x - 7$
- B  $y = 4x + 3$
- C  $y = -4x + 3$
- D  $y = -\frac{1}{4}x - 7$

M02651

### Solution

Parallel lines must have the same slope. The equation given to us,  $y = 4x - 7$ , is in slope-intercept form with a slope of “4.” The four possible answer choices are also in slope-intercept form. Notice that only the equation of choice B has a slope of “4.” Choice B is the only equation whose graph is parallel to  $y = 4x - 7$ , making it the correct answer.



## USING ALGEBRA I STANDARDS IN A REAL-LIFE SITUATION

The remaining five Algebra I standards are illustrated by a real-life problem, *Mixing a Prescription*, that a person might encounter while in college studying to become a pharmacist. Even though the CAHSEE doesn't include problems like this one, you might find it easier to remember one large problem—an “anchor problem”—in which many of the skills are combined, rather than trying to recall how to do each of the standards individually.

Try to do this problem before you look at its solution on the following pages.

 **Anchor Problem:**

### Mixing a Prescription

A pharmacist gets an order from a doctor for a prescription for hydrocortisone cream. The doctor wants the patient to get a 30 gram tube of cream with a 2% concentration of active ingredients. But the pharmacy has only two kinds of hydrocortisone cream on hand. Cream A has a 1% concentration and Cream B has a 2.5% concentration. How many grams of each cream should the pharmacist mix together to get 30 grams of cream with a 2% concentration of active ingredients?

## Mixing a Prescription: Solution and Standards

AI 15.0 Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems. [1 question]

The pharmacist will have to mix some amounts of Cream A and Cream B together, but how much of each?

To figure out how much of each cream to use, the pharmacist has to solve a “percent mixture problem.” Let’s look at the solution to this problem and see how the solution relates to several of the Algebra I standards.

### Step 1. Decide which variables to use.

We need to figure out how much of each kind of cream to mix together, so we can let

$a$  = the number of grams of Cream A, and

$b$  = the number of grams of Cream B.

### Step 2. Write the equations.

Because the pharmacist needs a total of 30 grams of the prescription, the first equation is

$$a + b = 30$$

The pharmacist also needs the prescription to have a concentration of 2% active ingredients. Where will the mixture’s active ingredients come from? Right! From the active ingredients in Cream A and Cream B. So, we know that

$$\begin{array}{r} \text{(Active ingredients in Cream A)} \\ + \text{(Active ingredients in Cream B)} \\ \hline = \text{(Active ingredients in prescription)} \end{array}$$

The grams of active ingredients in Cream A is (1% of  $a$ ) =  $0.01a$  and the grams of active ingredients in Cream B is (2.5% of  $b$ ) =  $0.025b$ . So, the second equation is

$$0.01a + 0.025b = 0.02(30)$$

### Step 3. Put the two equations together to make a system of equations:

$$\begin{cases} a + b = 30 \\ .01a + .025b = .02(30) \end{cases}$$

### Step 4. Find the values of $a$ and $b$ that make both of these equations true.

One way to solve the system is to solve the first equation for  $b$ :  $b = 30 - a$ , and then substitute into the second equation:

$$.01a + .025(30 - a) = .02(30)$$

We now have a single equation with only one variable to solve. We can simplify the left-hand side of this equation first by multiplying through by .025:

$$.01a + .025(30 - a) = .02(30)$$

$$.01a + .75 - .025a = .6$$

Then we combine like terms to get

$$-.015a + .75 = .6$$

AI 9.0 Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets. [1 question]

AI 4.0 Students simplify expressions before solving linear equations and inequalities in one variable, such as  $3(2x - 5) + 4(x - 2) = 12$ . [2 questions]



**Step 5. Solve the “two-step” linear equation:**

$$-.015a + .75 = .6$$

$$-.015a = -.15 \text{ (subtract .75 from both sides)}$$

$$a = 10 \text{ (divide both sides by } -.015\text{)}$$

The solution  $a = 10$  means we need to use 10 grams of Cream A.

But how many grams of Cream B are needed? To find out, substitute 10 in for  $a$  in the first equation:

$$a + b = 30 \text{ where } a = 10 \text{ gives}$$

$$10 + b = 30 \text{ so}$$

$$b = 20$$

So 20 grams of Cream B are needed.

**Step 6. Check the math by making sure the concentration of active ingredients in the mixture is correct.**

$$\text{Does } .01(10) + .025(20) = .02(30)?$$

Using the correct order of operations to simplify the left-hand side gives

$$.01(10) + .025(20) = .1 + .5 = .6, \text{ and also the right-hand side } .02(30) = .6.$$

Now that the math is done, the pharmacist is ready to prepare the prescription by mixing 10 grams of Cream A with 20 grams of Cream B. The mixture will contain 0.6 grams of active ingredients.

Now that you’ve read about all the Algebra I standards, it is time to answer the questions in the next section—the Practice Test—and then check your answers using the answer key provided at the end.

(Note: The CAHSEE questions used as examples throughout this Study Guide are questions that were used on prior CAHSEEs. These items will not be used in future CAHSEEs.)

AI 10.0 Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques. [1 question]

AI 5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step. [1 question]

## ALGEBRA I PRACTICE TEST

1. The perimeter,  $P$ , of a square may be found by using the formula  $\left(\frac{1}{4}\right)P = \sqrt{A}$ , where  $A$  is the area of the square. What is the perimeter of the square with an area of 36 square inches?

A 9 inches  
B 12 inches  
C 24 inches  
D 72 inches

M00057

4. Solve for  $x$ .

$$5(2x - 3) - 6x < 9$$

A  $x < -1.5$   
B  $x < 1.5$   
C  $x < 3$   
D  $x < 6$

M02938

2. Assume  $y$  is an integer and solve for  $y$ .

$$|y + 2| = 9$$

A  $\{-11, 7\}$   
B  $\{-7, 7\}$   
C  $\{-7, 11\}$   
D  $\{-11, 11\}$

M02242

5. What is the  $y$ -intercept of the line  $2x - 3y = 12$ ?

A  $(0, -4)$   
B  $(0, -3)$   
C  $(2, 0)$   
D  $(6, 0)$

M02591

3. Which of the following is equivalent to  $4(x + 5) - 3(x + 2) = 14$ ?

A  $4x + 20 - 3x - 6 = 14$   
B  $4x + 5 - 3x + 6 = 14$   
C  $4x + 5 - 3x + 2 = 14$   
D  $4x + 20 - 3x - 2 = 14$

M02936

6. What is the slope of a line parallel to the line  $y = \frac{1}{3}x + 2$ ?

A  $-3$   
B  $-\frac{1}{3}$   
C  $\frac{1}{3}$   
D  $2$

M02565

$$\begin{cases} 7x + 3y = -8 \\ -4x - y = 6 \end{cases}$$

7. What is the solution to the system of equations shown above?

A  $(-2, -2)$   
B  $(-2, 2)$   
C  $(2, -2)$   
D  $(2, 2)$

M02956

8. Mr. Jacobs can correct 150 quizzes in 50 minutes. His student aide can correct 150 quizzes in 75 minutes. Working together, how many minutes will it take them to correct 150 quizzes?

A 30  
B 60  
C 63  
D 125

M03000

## ALGEBRA I PRACTICE TEST ANSWER KEY

Question Number	Standard	Correct Answer
1	AI 2.0	C
2	AI 3.0	A
3	AI 4.0	A
4	AI 5.0	D
5	AI 6.0	A
6	AI 8.0	C
7	AI 9.0	B
8	AI 15.0	A

